

What is Claimed is:

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1 An active pixel sensor disposed on a semiconductor substrate, comprising:
a photosensor having a first terminal and a second terminal, said first terminal
coupled to a first reference potential;
5 a reset transistor having a first terminal coupled to said second terminal of said
photosensor, a second terminal coupled to a reset potential, and a third terminal coupled
to a reset line; and
a plurality of storage nodes coupled to said second terminal of said photosensor.

2. An active pixel sensor as in claim 1, further including means coupled to said
10 plurality of storage nodes for outputting a value from any of said plurality of storage
nodes.

3. An active pixel sensor as in claim 1, further including a plurality of transfer lines,
wherein each separate one of said plurality of storage nodes is coupled to said second
terminal of said photosensor by a separate one of a plurality of transfer transistors
15 having a first terminal connected to said second terminal of said photosensor, a second
terminal connected to said separate one of said plurality of storage nodes, and a third
terminal connected to a separate one of said plurality of transfer lines.

4. An active pixel sensor as in claim 2, wherein each separate one of said plurality of
storage nodes is coupled to said means for outputting a value from any of said plurality
20 of storage nodes by a separate one of a plurality of readout transistors having a first

terminal connected to said separate one of said plurality of storage nodes, a second terminal coupled to a second potential, and a third terminal connected to said means for outputting a value from any of said plurality of storage nodes.

5. An active pixel sensor as in claim 1, further including a plurality of storage

5 elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

6. An active pixel sensor as in claim 2, wherein said means for outputting a value includes:

10 a plurality of column output lines;

a row select line; and

15 a plurality of row select transistors, each of said row select transistors having a first terminal coupled to one of said plurality of storage nodes, a second terminal coupled to one of said plurality of column output lines, and a third terminal coupled to said row select line.

7. An active pixel sensor as in claim 6, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to said second terminal of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said second terminal of said photosensor, a second
20 terminal connected to said separate one of said plurality of storage nodes, and a third

terminal connected to a separate one of said plurality of transfer lines.

8. An active pixel sensor as in claim 6, wherein each separate one of said plurality of storage nodes is coupled to said first terminal of a separate one of said plurality of row select transistors by a separate one of a plurality of readout transistors having a first terminal connected to said separate one of said plurality of storage nodes, a second terminal coupled to a second potential, and a third terminal coupled to said first terminal of said separate one of said plurality of row select transistors.

9. An active pixel sensor as in claim 6, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

10. An active pixel sensor as in claim 2, wherein said means for outputting a value includes:

a plurality of row select lines;

a column output line; and

a plurality of row select transistors, each of said row select transistors having a first terminal coupled to one of said plurality of storage nodes, a second terminal coupled to said column output line, and a third terminal coupled to one of said plurality of row select lines.

11. An active pixel sensor as in claim 10, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to said second terminal of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said second terminal of said photosensor, a second terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of said plurality of transfer lines.

12. An active pixel sensor as in claim 10, wherein each separate one of said plurality of storage nodes is coupled to said first terminal of a separate one of said plurality of row select transistors by a separate one of a plurality of readout transistors having a first terminal connected to said separate one of said plurality of storage nodes, a second terminal coupled to a second potential, and a third terminal coupled to said first terminal of said separate one of said plurality of row select transistors.

13. An active pixel sensor as in claim 10, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

14. An active pixel sensor as in claim 2, wherein said means for outputting a value includes:

a row select line;

a column output line;

a plurality of image select lines;

a row select transistor having a first terminal coupled to said row select line, a second terminal coupled to said column output line, and a third terminal; and

a plurality of image select transistors, each of said image select transistors having a first terminal coupled to one of said plurality of storage nodes, a second terminal coupled to said third terminal of said row select transistor, and a third terminal coupled to one of said plurality of image select lines.

15. An active pixel sensor as in claim 14, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to said second terminal of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said second terminal of said photosensor, a second terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of said plurality of transfer lines.

16. An active pixel sensor as in claim 14, wherein each separate one of said plurality of storage nodes is coupled to said first terminal of a separate one of said plurality of image select transistors by a separate one of a plurality of readout transistors having a first terminal connected to said separate one of said plurality of storage nodes, a second terminal coupled to a second potential, and a third terminal coupled to said first terminal of said separate one of said plurality of image select transistors.

17. An active pixel sensor as in claim 16, further including a plurality of storage

elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

18. An active pixel sensor as in claim 4, wherein said means for outputting a value
5 includes:

a row select line;

a column output line;

a plurality of image select lines, each separate one of plurality of image select
lines coupled to separate ones of said third terminal of said readout transistors; and

10 a row select transistor having a first terminal coupled to said row select line, a
second terminal coupled to said column output line, and a third terminal coupled to each
said second terminal of said plurality of readout transistors.

19. An active pixel sensor as in claim 18, further including a plurality of transfer lines,
wherein each separate one of said plurality of storage nodes is coupled to said second
15 terminal of said photosensor by a separate one of a plurality of transfer transistors
having a first terminal connected to said second terminal of said photosensor, a second
terminal connected to said separate one of said plurality of storage nodes, and a third
terminal connected to a separate one of said plurality of transfer lines.

20. An active pixel sensor as in claim 18, further including a plurality of storage
20 elements, each separate one of said storage elements having a first terminal coupled to a

separate one of said storage nodes, and a second terminal coupled to a second reference potential.

21. An active pixel sensor as in claim 2, wherein said means for outputting a value includes:

5 a plurality of column output lines;
a plurality of row select lines; and
a plurality of row select transistors, each of said row select transistors having a first terminal coupled to one of said plurality of storage nodes, a second terminal coupled to one of said plurality of column output lines, and a third terminal coupled to one of
10 said plurality of row select lines.

22. An active pixel sensor as in claim 21, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to said second terminal of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said second terminal of said photosensor, a second
15 terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of said plurality of transfer lines.

23. An active pixel sensor as in claim 21, wherein each separate one of said plurality of storage nodes is coupled to said first terminal of one of said plurality of row select transistors by a separate one of a plurality of readout transistors having a first terminal
20 connected to said one of said plurality of storage nodes, a second terminal coupled to a

second potential, and a third terminal coupled to said first terminal of said one of said plurality of row select transistors.

24. An active pixel sensor as in claim 21, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes and a second terminal coupled to a second reference potential.

25. An active pixel sensor as in claim 4, wherein said means for outputting a value includes:

a row select line;

a column bias line;

first and second column output lines;

a row select transistor having a first terminal coupled to said row select line, a second terminal coupled to said column bias line, and a third terminal; and

wherein said plurality of storage nodes includes a first node and second storage node, said first storage node is coupled to said means for outputting a value by a first readout transistors having a first terminal coupled to said first storage node, a second terminal coupled to said first column output line, and a third terminal connected to said third terminal of said row select transistor, and said second storage node is coupled to said means for outputting a value by a second readout transistor having a first terminal coupled to said second storage node, a second terminal coupled to said second column output line, and a third terminal connected to said third terminal of said row select

transistor

26. An active pixel sensor as in claim 25, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to said second terminal of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said second terminal of said photosensor, a second terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of said plurality of transfer lines.

27. An active pixel sensor as in claim 25, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

28. An active pixel sensor disposed on a semiconductor substrate, comprising:
a photosensor having a first terminal and a plurality of second terminals, said first terminal coupled to a first reference potential;

a reset transistor having a first terminal coupled to said at least one of said plurality of second terminals of said photosensor, a second terminal coupled to a reset potential, and a third terminal coupled to a reset line; and

a plurality of storage nodes, each of said plurality of storage nodes coupled to a separate one of said second terminals of said photosensor.

29. An active pixel sensor as in claim 28, further including means coupled to said plurality of storage nodes for outputting a value from any of said plurality of storage nodes.

30. An active pixel sensor as in claim 28, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to one of said plurality of second terminals of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said one of said plurality of second terminals of said photosensor, a second terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of said plurality of transfer lines.

31. An active pixel sensor as in claim 29, wherein each separate one of said plurality of storage nodes is coupled to said means for outputting a value from any of said plurality of storage nodes by a separate one of a plurality of readout transistors having a first terminal connected to said separate one of said plurality of storage nodes, a second terminal coupled to a second potential, and a third terminal connected to said means for outputting a value from any of said plurality of storage nodes.

32. An active pixel sensor as in claim 28, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference

potential.

33. An active pixel sensor as in claim 29, wherein said means for outputting a value includes:

a plurality of column output lines;

a row select line; and

a plurality of row select transistors, each of said row select transistors having a first terminal coupled to one of said plurality of storage nodes, a second terminal coupled to one of said plurality of column output lines, and a third terminal coupled to said row select line.

34. An active pixel sensor as in claim 33, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to one of said plurality of second terminals of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said one of said plurality of second terminals of said photosensor, a second terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of said plurality of transfer lines.

35. An active pixel sensor as in claim 33, wherein each separate one of said plurality of storage nodes is coupled to said first terminal of a separate one of said plurality of row select transistors by a separate one of a plurality of readout transistors having a first terminal connected to said separate one of said plurality of storage nodes, a second

terminal coupled to a second potential, and a third terminal coupled to said first terminal of said separate one of said plurality of row select transistors.

36. An active pixel sensor as in claim 33, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

37. An active pixel sensor as in claim 29, wherein said means for outputting a value includes:

a plurality of row select lines;

a column output line; and

a plurality of row select transistors, each of said row select transistors having a first terminal coupled to one of said plurality of storage nodes, a second terminal coupled to said column output line, and a third terminal coupled to one of said plurality of row select lines.

38. An active pixel sensor as in claim 37, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to one of said plurality of second terminals of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said one of said plurality of second terminals of said photosensor, a second terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of

said plurality of transfer lines.

39. An active pixel sensor as in claim 37, wherein each separate one of said plurality of storage nodes is coupled to said first terminal of a separate one of said plurality of row select transistors by a separate one of a plurality of readout transistors having a first terminal connected to said separate one of said plurality of storage nodes, a second terminal coupled to a second potential, and a third terminal coupled to said first terminal of said separate one of said plurality of row select transistors.

40. An active pixel sensor as in claim 37, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

41. An active pixel sensor as in claim 29, wherein said means for outputting a value includes:

a row select line;

a column output line;

a plurality of image select lines;

a row select transistor having a first terminal coupled to said row select line, a second terminal coupled to said column output line, and a third terminal; and

a plurality of image select transistors, each of said image select transistors having a first terminal coupled to one of said plurality of storage nodes, a second terminal coupled

to said third terminal of said row select transistor, and a third terminal coupled to one of said plurality of image select lines.

42. An active pixel sensor as in claim 41, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to one of said plurality of second terminals of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said one of said plurality of second terminals of said photosensor, a second terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of said plurality of transfer lines.

43. An active pixel sensor as in claim 41, wherein each separate one of said plurality of storage nodes is coupled to said first terminal of a separate one of said plurality of image select transistors by a separate one of a plurality of readout transistors having a first terminal connected to said separate one of said plurality of storage nodes, a second terminal coupled to a second potential, and a third terminal coupled to said first terminal of said separate one of said plurality of image select transistors.

44. An active pixel sensor as in claim 43, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

45. An active pixel sensor as in claim 31, wherein said means for outputting a value includes:

a row select line;

a column output line;

5 a plurality of image select lines, each separate one of plurality of image select lines coupled to separate ones of said third terminal of said readout transistors; and
a row select transistor having a first terminal coupled to said row select line, a second terminal coupled to said column output line, and a third terminal coupled to each said second terminal of said plurality of readout transistors.

10 46. An active pixel sensor as in claim 45, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to one of said plurality of second terminals of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said one of said plurality of second terminals of said photosensor, a second terminal connected to said separate one
15 of said plurality of storage nodes, and a third terminal connected to a separate one of said plurality of transfer lines.

47. An active pixel sensor as in claim 45, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference
20 potential.

48. An active pixel sensor as in claim 29, wherein said means for outputting a value includes:

a plurality of column output lines;

a plurality of row select lines; and

5 a plurality of row select transistors, each of said row select transistors having a first terminal coupled to one of said plurality of storage nodes, a second terminal coupled to one of said plurality of column output lines, and a third terminal coupled to one of said plurality of row select lines.

49. An active pixel sensor as in claim 48, further including a plurality of transfer lines,
10 wherein each separate one of said plurality of storage nodes is coupled to one of said plurality of second terminals of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said one of said plurality of second terminals of said photosensor, a second terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of
15 said plurality of transfer lines.

50. An active pixel sensor as in claim 48, wherein each separate one of said plurality of storage nodes is coupled to said first terminal of one of said plurality of row select transistors by a separate one of a plurality of readout transistors having a first terminal connected to said one of said plurality of storage nodes, a second terminal coupled to a
20 second potential, and a third terminal coupled to said first terminal of said one of said plurality of row select transistors.

51. An active pixel sensor as in claim 48, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

5 52. An active pixel sensor as in claim 31, wherein said means for outputting a value includes:

a row select line;

a column bias line;

first and second column output lines;

10 a row select transistor having a first terminal coupled to said row select line, a second terminal coupled to said column bias line, and a third terminal; and

wherein said plurality of storage nodes includes a first node and second storage node, said first storage node is coupled to said means for outputting a value by a first readout transistors having a first terminal coupled to said first storage node, a second terminal coupled to said first column output line, and a third terminal connected to said third terminal of said row select transistor, and said second storage node is coupled to said means for outputting a value by a second readout transistor having a first terminal coupled to said second storage node, a second terminal coupled to said second column output line, and a third terminal connected to said third terminal of said row select

20 transistor

53. An active pixel sensor as in claim 52, further including a plurality of transfer lines, wherein each separate one of said plurality of storage nodes is coupled to one of said plurality of second terminals of said photosensor by a separate one of a plurality of transfer transistors having a first terminal connected to said one of said plurality of second terminals of said photosensor, a second terminal connected to said separate one of said plurality of storage nodes, and a third terminal connected to a separate one of said plurality of transfer lines.

54. An active pixel sensor as in claim 52, further including a plurality of storage elements, each separate one of said storage elements having a first terminal coupled to a separate one of said storage nodes, and a second terminal coupled to a second reference potential.

55. A method of operating an active pixel sensor having a photosensor, a reset transistor, a plurality of storage nodes coupled to said photosensor and means coupled to said plurality of storage nodes for outputting a value from any of said plurality of storage nodes comprising the steps of:

turning on the reset transistor to place a reset potential on said photosensor;

transferring charge from said photosensor to a first of the plurality of storage nodes for a first duration; and

transferring charge from said photosensor to a second of the plurality of storage nodes for a second duration.

57. A method of operating an active pixel sensor as in claim 55 wherein said second duration commences after said first duration has ended.

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